

The University of Chicago

THE EFFECT OF TRAINING
ON THE TEMPO OF DEVELOPMENT
OF GRAPHIC REPRESENTATION
IN PRESCHOOL CHILDREN

A PART OF A DISSERTATION SUBMITTED TO
THE FACULTY OF THE DIVISION OF THE
SOCIAL SCIENCES IN CANDIDACY FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

HUMAN DEVELOPMENT

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THE PROBLEM

The central problem attacked in this investigation has been that of measuring the effects of a certain type of training on the speed of development of skill in graphic representation as studied through the medium of easel painting. An essential step in the development of artistic expression in the young child is learning that objects can be represented. This idea and some skill in carrying it out has been found to be acquired during the preschool years. It has been noted in an earlier study by Marian Monroe¹ that preschool children go through a typical sequence of development in learning to represent graphically. Our training methods were designed specifically to aid in speeding our experimental subject's progress through the following stages outlined by Monroe: (1) Scribble-unnamed, (2) Scribble-named, (3) Diagram, (4) Design, and (5) Representation. An attempt was made in the present experiment to minimize training in the more strictly aesthetic aspects of painting, the representative qualities being those on which attention was focused.

In order adequately to measure the effects of the training each experimental child was paired with an untrained control child. Thus, if measurably greater progress was made by the trained children in the time allotted to the experiment we would have reason to suspect that our training techniques had been successful in increasing our subject's rate of learning this particular skill.

Our problem is related to several other areas of inquiry, namely, those concerned with the question of (1) the development of learned and unlearned behavior, (2) the development of aesthetic and symbolic processes, and (3) pedagogical techniques in nursery education.

* An Article Based on the Essential Portions of a Ph.D. Dissertation in Human Development, the University of Chicago, 1946.

¹ Marian Monroe, "The Drawings and Color Preferences of Young Children", Unpublished Ph.D. Dissertation, the University of Chicago, 1929.

Both theoretically and methodologically this research is partially analogous to studies made by Munn,² Shirley,³ Hilgard,⁴ Dennis,⁵ Gesell,⁶ and Carmichael⁷ who have each attempted to discover the degree of learnedness of various behavior items. Our experiment differs from most of the studies mentioned in that our control children were not trained at a later date than the experimental in order to determine the effect of greater maturity on speed of learning. Our finding, on the other hand, is to the effect that training is influential in increasing the tempo of learning of a particular complex of skills and ideas which we term graphic representation is on the whole consistent with the findings of previous researches of a similar nature. What we were dealing with was what might be termed a behavior-pattern (using McGraw's⁸ concept) which was found to be at a stage of relative modifiability through training at the preschool level. We measured the effect of a specific kind of training in speeding up the tempo of emergence of this pattern, and found the effect to be significant, at least for a few months immediately following the application of the training. Thus the present study finds its place in the more general fields of genetic and educational psychology.

In regard to teaching methods let us remark that we are in agreement with such per-

² N. L. Munn, *Psychological Development* (New York: Houghton-Mifflin Co., 1938), pp. 1-332.

³ M. M. Shirley, "Locomotor and Visual-manual Functions in the First Two Years," *A Handbook of Child Psychology*, 2nd ed., ed. by Carl Murchison (Worcester: Clark University Press, 1933), Ch. V.

⁴ J. R. Hilgard, "Learning and Maturation in Preschool Children," *Journal of Genetic Psychology*, XLI (1932), pp. 36-56.

⁵ Wayne Dennis, "The Effect of Restricted Practice Upon the Reaching, Sitting, and Standing of Two Infants," *Journal of Genetic Psychology*, XLVII (1935), pp. 17-32.

⁶ Arnold Gesell, *The Mental Growth of the Preschool Child* (New York: MacMillan Company, 1926), pp. x+447.

⁷ Leonard Carmichael, "A Re-evaluation of the Concepts of Maturation and Learning," *Psychological Review*, XLIII (1935), pp. 450-470.

⁸ M. B. McGraw, *Growth: A Study of Johnny and Jimmy* (New York: D. Appleton-Century Co., 1935), pp. xxi+319.

sons as Dewey,⁹ Pearson,¹⁰ Mearns,¹¹ and Cole¹² when they contend that the child cannot be left to solve all his artistic production problems alone, and that the teacher can successfully function as a catalytic agent in his development.

THE EXPERIMENT

Our subjects were fifty-two preschool children divided equally between an experimental and a control group. The research was initiated with a larger number of subjects, but due to illness, uncooperativeness and some turn-over in the school population a number of pairs had to be dropped.

The method used in this study involved the setting up of parallel experimental and control groups with pairs from each of the classes at the University of Chicago Nursery School, i.e., from the two-year-old, younger three-year-old, older three-year-old, and four-year-old groups. The pair members in addition to being enrolled in the same nursery school class, were matched on the basis of sex, age and to a certain extent, drawing interest. There were two reasons for drawing the members of any given pair from the same nursery school class. One reason was practicality; but vastly more important was the second reason, namely, that this arrangement helped to prevent the experiential background of the children constituting any pair from being widely different, at least insofar as the nursery school situation was concerned. Sex was chosen as a basis for pairing because numerous researchers have found that sex differences occur fairly consistently in the art products of young children. We refer, for example, to studies by Goodenough,¹³ Dennis,¹⁴ Lehman and Witty,¹⁵ Lark-Horovitz,¹⁶ and McCarty.¹⁷

⁹ John Dewey, et al., *Art and Education* (Rahway, N. J.: Barnes Foundation Press, 1929), pp. 180-183.

¹⁰ Ralph Pearson, *The New Art Education* (New York: Harper Bros., 1941), pp. 207-214.

¹¹ Hughes Mearns, "Creative Spirit and Its Significance for Education," *Creative Expression* (Milwaukee: E. M. Hale and Co., 1939), pp. 13-21.

¹² N. R. Cole, *The Arts in the Classroom* (New York: John Day Co., 1940), p. 3.

¹³ F. L. Goodenough, *The Measurement of Intelligence by Drawing* (Yonkers: World Book Co., 1926), p. 57.

¹⁴ Wayne Dennis, "The Performance of Hopi Children on the Goodenough Draw-a-Man Test," *Journal of Comparative Psychology*, XXXIV (1942), pp. 341-348.

¹⁵ H. C. Lehman and P. A. Witty, "Play Interests as Evidence of Sex Differences in Aesthetic Appreciation," *American Journal of Psychology*, XL (1928), p. 455.

¹⁶ Betty Lark-Horovitz, "On Art Appreciation of Children: III Textile Pattern Preference and Study," *Journal of Educational Research*, XXXIII (1939), p. 34.

¹⁷ Stella McCarty, *Children's Drawings* (Baltimore: Williams and Wilkins Co., 1924), p. 25.

There could be little doubt as to the desirability of pairing experimental and control children on the basis of age, since practically all research on the development of drawing in children points to rapid changes with increase in age. The reader is referred to the investigations by Rouma,¹⁸ McCarty,¹⁹ Goodenough,²⁰ as well as some by Gesell²¹ who comment on the importance of the factor of neuro-muscular maturity as related to age in the evolution of drawing. The study by Monroe²² from which the present research stems, resulted in the setting up of an age scale for measuring development of skill in drawing.

Since we were not able always to match pair members exactly in age, we permitted a maximum difference of four months. The mean absolute difference in age for our two groups of subjects was, however, only 1.07 months.

The interest of the children in painting was also taken into account in a rough way in pairing experimental and control subjects because motivation is an important determinant of learning rate, and ours was to be a study of learning. No precise measuring procedure was used for gauging interest, this trait being judged rather by observing the frequency with which each child asked to paint, the time he spent at the easel, and the enthusiasm and attention he displayed when art materials were presented.

The first step in the research consisted in the collection of paintings made spontaneously by all the children in the Nursery School during the free play period throughout the Autumn Quarter of 1942 (Pre-training Period). The art work in the Nursery School free-play period was carefully planned by the experimenter and the teachers to insure that a minimum of training was given at this time. Each child's comments concerning his paintings, along with his name and the date of execution of the painting were written immediately upon its completion on each picture drawn. At the end of the period the paintings were classified on the basis of a scheme which was a slight modification of Monroe's system, the major modification consisting in the omission of Monroe's "letters" category. The

¹⁸ George Rouma, *Le Langage Graphique l'Enfant* (Paris: Misch et Thron, 1913), pp. 1 ff.

¹⁹ McCarty, *op. cit.*, pp. 134-135.

²⁰ Goodenough, *op. cit.*, pp. 1-177.

²¹ Gesell, *op. cit.*, pp. x-447.

²² Monroe, *op. cit.*, pp. 1-16.

categories in terms of which the paintings were classified included the following: Scribble-unnamed, Scribble-named, Diagram, Design, and Representation. Let us describe these classes briefly. All paintings consisting of decorating the page with lines or blobs, or solid masses of color, if left unnamed, were classified in the category, scribble-unnamed.

(2) The same types of paintings as the above, if given a name by the child, were placed in the category, scribble-named. (3) The drawings which were placed in the class, diagram, consisted of lines and masses of color having a definite relationship to each other which was explained by the child in the verbal report of the drawing. The depiction of spatial relationships rather than the details of appearance was the diagnostic feature of diagram drawings. (4) All drawings in which lines or masses were repeated in some rhythmic sequence or regular order were classified as design. (5) All drawings which looked like the object named by the child sufficiently to be recognized as that object by the experimenter were placed in the category, representation.

It was not difficult to classify a painting in accordance with the scheme just described. However, as a guard against any possible bias of the experimenter's, another competent person was called upon to check the experimenter's classifications. Disagreement between judges was rare, i.e., they occurred in approximately one percent of the instances.

At the end of the pre-training period the children in the Nursery School were paired, as we have described, according to nursery school class, sex, age, and interest.

During the Winter Quarter of 1943 (Training Period) the children in the experimental group were given training. A standardized procedure was organized. Each child in the experimental group was taken by the investigator at each training session to the experimental room where painting materials were arranged. The materials consisted of an easel, 16" x 24" news print paper, water soluble vegetable paints in four colors—red, blue, green, and yellow—and long-handled brushes one-half inch wide. This equipment is identical with that used at the Nursery School, and consequently was familiar to the children. Since the purpose of the training was to accelerate the child's development from one stage to another in the painting scale, the

specific training method used in a given instance depended upon the stage of development that the child was in at the time of training. Once the child's level was recognized, training was directed toward the next higher stage. The child, after introductory pleasantries was asked to paint some pictures. Enthusiasm was evidenced by most subjects.

The following passages give a description of the framework of the formalized training procedure: The teacher waited until the child had completed his first picture, and then she said, "Tell me about your picture." As a result of his answer and the nature of the painting produced, the experimenter immediately classified the product. On the basis of this classification of the first picture produced the experimenter continued with one of the following series of comments. The sequence was repeated for each picture the child painted during the training session (usually not more than two or three pictures, a restriction necessitated because of time limitations), unless, of course, a variation occurred in the level of the child's work.

(1) When the first picture fell into the category, *Scribble*, the training was directed toward helping the child produce a picture at the scribble-named level, i.e., toward giving him the idea that the picture he painted might be about some object. Following is the series of comments the experimenter adhered to:

"Tell me about your picture."

If there was no response E continued "What does your picture look like?"

If there was no response E continued "Is it a kitty?"

If there was no response E continued "Does it look like a doggie?"

If there was no response E continued "Tell me about your picture."

Whether or not there was a response E concluded "If you look carefully at your picture you can see that it is about something."

(2) When the child's initial product was of the *Scribble-named* variety, the training was directed toward carrying him to the diagram level by the following method. This is the sequence of remarks used in this case:

"Tell me about your picture."

If the child had given a general name E continued "Tell me more about it."

If there was no response E continued "What is this part?" (pointing)

Whether or not there was an answer, E continued "What is this part?" (pointing to another place)

Whether or not there was an answer, E concluded "If you look carefully you can see that there are lots of parts to your picture, and they make something nice altogether."

The idea here was to give the child the notion of complex content as well as the relationship of parts to the whole and to each other. This was accomplished by the questions and comments put to the child by the experimenter.

(3) Should the child's product be a *Diagram*, the training was directed toward getting him to produce a painting that was a recognizable representation of something by the following method:

After the experimenter had asked the child to tell about the picture, and after the child had finished describing it the experimenter made a simple line drawing of whatever the child had been trying to paint. Then the experimenter said, "This is what a (e.g.) house looks like too, isn't it? Now what else are you going to paint?"

When the child had answered, the experimenter continued, "That is a fine idea. Be sure that it looks like a (e.g.) boat. I'm sure that you can make it look like a boat."

The purpose of the above was to improve the child's attempts at representation by giving him direct visual aids and a great deal of encouragement, but to avoid teaching him merely to copy.

(4) Since the product classified as *Design*, was in a sense a form of representation, the child was encouraged to achieve the more conventional recognizable forms merely by the following method:

After the child had completed a design painting, the experimenter said, "Now let's paint a picture about something. You tell me what you are going to paint a picture about."

If the child did not immediately respond with an idea E continued "It might be a house, or a lady, or a bear, or anything at all that you are interested in painting."

If the child preferred to continue painting designs, no further urging to represent was given.

(5) Since a product involving the recognizable representation of something showed that the child had captured the idea of graphic symbolism, the training at this level was directed toward encouraging the child not only to maintain, but also to improve upon the work which he had achieved. To this end the following method was applied:

After the child had finished painting and had described his picture, the experimenter would say

"That is one of the very nicest pictures you have ever made. I hope you will make one just as nice for me the next time."

Then the experimenter would call attention to interesting features of detail, proportion, color, composition, etc., depending upon the nature of the particular picture painted.

It will be noted that only at this point was the aesthetic quality of the painting involved in the instruction. The aesthetic quality did not, however, enter into the original classification of a painting as representation.

The formalized procedure which has just been described had naturally to vary somewhat for the sake of interest and in accordance with the conversation which the child made, but the basic pattern was maintained. A complete diary of each training session was kept so that exactly what was said by experimenter and child is a matter of record. These records indicate that the outline set forth above was adhered to closely, the incidental remarks occurring in addition to, rather than to the exclusion of, the basic pattern. The essential features of the guidance technique were unvarying.

During the Spring Quarter of 1943 (Post-training Period) training was discontinued and the paintings produced spontaneously in the art periods of the various groups were again collected. These were classified as were the pre-training paintings on the basis of the modified Monroe scheme.

After the paintings had been classified a "drawing" score was computed for each child. The system of scoring drawings devised by Monroe was borrowed. Let us turn to Monroe herself for a description of her method:

... some individuals within each group influence the total number of drawings to a greater extent than others. Some of the children who came to the easels frequently have a large number of drawings included in their group while others who came to the easels only a few times contribute but a small proportion to the total drawings. In order to avoid this weighting in the direction of a few individuals a method of scoring was adopted whereby each child could be assigned a numerical value in terms of his average developmental stage in drawing. In order to do this, the types of drawings were ranked in order of the age at which they appeared most frequently. The unnamed scribble drawings have their highest percentage at the youngest age group. This class was arbitrarily given the score of 1. The other types of drawings all show an increase with age. This increase is most rapid in the case of the scribble-named drawings which maintain a level from three years of age. This class as the second stage in drawing was given the score of 2. Diagrammatic drawings reach their peak at three and one-half years. This class was given the score of 3. Design, representation, and letters all increase simultaneously and have their greatest frequency at the oldest age group, four and one-half years. These classes were each assigned the score of 4. The score given to each class of drawings conforms as closely as can be determined to the order of its appearance in the development of drawing. Each child was then given a score in drawing by computing the average score of all his drawings.²³

STATISTICAL ANALYSIS

Essentially there are five questions which must be answered by the experiment: (1) What is the relationship between the two groups, i.e., experimental and control, in their level of development in graphic expression at the start of the experiment? (2) What is the relation of the level of development for each group in the post-training period to its own level of development in the pre-training period? (3) Does the experimental group show a development between the two periods significantly greater than that of the control group? (4) What is the relationship between the two groups in their level of graphic ex-

pression in the post-training period? (5) Are there any factors revealed by the data, other than the training received by the experimental group, which may account for the observed differences?

It is desirable to determine whether the two groups matched on the basis of nursery school class, sex, age, and drawing interest had similar levels of development in graphic expression at the initiation of the experiment.

Table I lists the children in each group, giving the background data on the basis of which they were matched, and each child's drawing score in the pre-training period. The control group has a mean drawing score of 1.52 while the experimental group has a mean drawing score of 1.70. The difference between these two means is 0.18 with a standard error²⁴ of ± 0.07 . The value of t is 2.57. This leads to the conclusion that the mean drawing scores were different at approximately the two-percent level of confidence,²⁵ prior to the training of the experimental group.

Now let us ask whether the improvement made in the post-training period by each group relative to its own initial mean drawing score was significant. If the training was successful, the experimental group at least should certainly show a significant improvement. If both should show a gain in skill one would expect the trained group to advance the greater amount.

Table II shows the scores in both periods together with the differences in the scores for each group. The control group improved its average score from 1.52 to 1.75, a difference of 0.23 points. The standard error of the distribution of this difference is ± 0.08 , making the value of t 2.88. The improvement in the control group was, therefore, probably significant at the one-percent level.

The experimental group, on the other hand, improved from a mean score of 1.70 to a mean score of 2.48. The difference is 0.78 ± 0.10 , the value of t being 7.8. The latter statistic indicates a highly significant difference. Thus the control group showed some improvement and the experimental group highly significant improvement, the trained children gaining almost three and one-half times as many drawing score points as the non-trained children.

²⁴ C. C. Peters and W. R. VanVoorhis, *Statistical Procedures and their Mathematical Bases* (New York: McGraw-Hill, 1940), p. 165.

²⁵ *Ibid.*, p. 173.

²³ *Ibid.*, pp. 27-28.

TABLE I

BACKGROUND CHARACTERISTICS AND DRAWING SCORES OF THE EXPERIMENTAL AND CONTROL GROUPS IN THE PRE-TRAINING PERIOD

Nursery School Class	Pair Number	Sex	Control Group		Experimental Group		Difference in Mean Drawing Scores of Pair Members
			Age*	Drawing Score	Age*	Drawing Score	
Two-Year-Olds -----	1	F	2-3	1.1	2-3	1.5	0.4
	2	M	2-3	1.0	2-4	1.1	0.1
	3	F	2-0	1.0	2-0	1.0	0.0
	4	M	2-7	1.0	2-6	1.0	0.0
	5	M	2-3	1.0	2-3	1.5	0.5
	6	F	2-4	1.0	2-6	1.6	0.6
Younger Three-Year-Olds ..	7	F	3-3	1.6	3-3	1.8	0.2
	8	M	3-5	1.8	3-5	2.0	0.2
	9	M	2-10	2.0	2-8	1.0	-1.0
	10	F	2-10	1.9	3-2	2.0	0.1
	11	M	2-11	1.9	2-11	2.0	0.1
	12	M	2-11	1.8	2-11	1.8	0.0
Older Three Year-Olds -----	13	M	3-7	1.8	3-6	2.0	0.2
	14	M	3-8	1.6	3-8	1.8	0.2
	15	F	4-0	1.8	3-11	2.0	0.2
	16	M	4-0	1.8	4-0	1.4	-0.4
	17	M	3-11	1.4	3-11	1.4	0.0
	18	M	3-9	1.5	3-8	1.6	0.1
Four-Year-Olds -----	19	F	3-7	1.7	3-9	1.5	-0.2
	20	F	3-11	1.7	4-0	2.3	0.6
	21	M	4-6	1.6	4-4	2.0	0.4
	22	M	4-3	1.0	4-0	1.4	0.4
	23	F	4-7	1.9	4-8	2.4	0.5
	24	F	4-2	1.8	4-6	1.9	0.1
	25	F	4-2	1.7	4-3	2.5	0.8
	26	M	3-10	1.2	3-11	1.7	0.5
Total -----				39.6	-----	44.2	4.6
Mean -----				3-3	-----	3-5	1.70
Sigma of Distribution -----							0.18
							.35
							.41

*As of October 1, 1942.

The question as to the equality of the units with which we are dealing must be raised. Evidence bearing indirectly on this question will be given shortly, but first let us present another line of evidence bearing on the question of relative gains. The difference between the mean gains in the two groups is 0.55 (0.78 — 0.23), while the standard error²⁶ of the difference in mean gains is ± 0.12 . The fact that the value of *t* is 4.58, indicates that the inter-group difference is highly significant. The extent of the improvement made by the experimental group was significantly greater than that achieved by the control group.

There is one final step in the basic analysis of the data. The mean drawing scores in the post-training period are: Control group—1.75; experimental group—2.48. The difference between the mean post-training scores is 0.73 with a standard error²⁷ of ± 0.059 . The

value of *t* is 12.4. The difference is obviously highly significant.

The question may well be raised at this point as to whether or not the initial advantage of a higher average score for the experimental group resulted only in apparent greater improvement, the units at the higher levels of the rating scale being perhaps of lesser magnitude than those at the lower. It is possible to check on this problem by determining whether any group of children who score high on a test of graphic expression show a greater improvement in score after a period of time than a comparable group of children who scored low initially. It is very simple to test this point from our data. Taking the ten children who at the start of the experiment in the pre-training period scored lowest in the control group, we find that on the average they improved their score 0.3 points in the post-training period. The ten control children who initially scored highest

²⁶ *Ibid.*, pp. 167-168.
²⁷ R. L. Thorndike, "Regression Fallacies in the Matched Groups Experiment," *Psychometrika*, VII (1942), p. 88.

TABLE II

DRAWING SCORES OF THE EXPERIMENTAL AND CONTROL GROUPS IN THE PRE- AND POST-TRAINING PERIODS

Pair Number	Control Group			Experimental Group			Difference between Experimental and Control Differences
	Pre-training	Post-training	Difference	Pre-training	Post-training	Difference	
1	1.1	1.5	0.4	1.5	2.4	0.9	0.5
2	1.0	1.6	0.6	1.1	2.5	1.4	0.8
3	1.0	1.2	0.2	1.0	1.8	0.8	0.6
4	1.0	1.4	0.4	1.0	2.2	1.2	0.8
5	1.0	1.3	0.3	1.5	2.8	1.3	1.0
6	1.0	1.0	0.0	1.6	2.2	0.6	0.6
7	1.6	2.0	0.4	1.8	2.4	0.6	0.2
8	1.8	1.6	-0.2	2.0	3.2	1.2	1.4
9	2.0	1.8	-0.2	1.0	2.3	1.3	1.5
10	1.9	2.0	0.1	2.0	2.6	0.6	0.5
11	1.9	1.9	0.0	2.0	2.3	0.3	0.3
12	1.8	1.7	-0.1	1.8	2.3	0.5	0.6
13	1.8	1.8	0.0	2.0	2.4	0.4	0.4
14	1.6	1.5	-0.1	1.8	1.5	-0.3	-0.2
15	1.8	1.7	-0.1	2.0	2.3	0.3	0.4
16	1.8	1.5	-0.3	1.4	2.3	0.9	1.2
17	1.4	1.3	-0.1	1.4	2.2	0.8	0.9
18	1.5	1.5	0.0	1.6	2.0	0.4	0.4
19	1.7	1.0	-0.7	1.5	3.2	1.7	2.4
20	1.7	2.4	0.7	2.3	2.1	-0.2	-0.9
21	1.6	2.7	1.1	2.0	3.7	1.7	0.6
22	1.0	1.6	0.6	1.4	2.6	1.2	0.6
23	1.9	3.4	1.5	2.4	3.1	0.7	-0.8
24	1.8	2.6	0.8	1.9	2.4	0.5	-0.3
25	1.7	1.7	0.0	2.5	2.9	0.4	0.4
26	1.2	1.9	0.7	1.7	2.7	1.0	0.3
Total---	39.6	45.6	6.0	44.2	64.4	20.2	14.2
Mean --	1.52	1.75	0.23	1.70	2.48	0.78	0.55

improved their scores on the average only 0.15 points, just half as much in points as their low-scoring mates. The same relationship is true of the experimental group. The ten lowest scoring children improved on the average 1.15 points after receiving the training, while the ten highest members of the experimental group did only half as well, improving 0.59 points, on the average, after being trained. The evidence is strongly suggestive that the higher average initial score, among the experimental children was not only not an advantage, but that the advantage lay with the group which measured low initially in the drawing score scale.

The problem of the effect on differences in group behavior of initial disparity in drawing scores we have attacked further by using a new pairing of experimental and control children. If we start with pairs of children who are matched exactly in initial drawing score, then we eliminate initial inequality as a factor in improvement rate. Table III shows twelve pairs of children who are matched ex-

actly in initial drawing score. The mean difference between experimental and control subjects in the post-training period is 0.63 points in favor of the experimental group. The standard error of this difference is ± 0.199 . The ratio of the difference to the standard error of the difference is 3.18, a fact which indicates significance between the two-percent and one-percent levels of confidence and supports our other evidence to the effect that training of the type given tends to speed progress in ability to represent graphically.

It is of further interest to consider what happened to the variability of scores in the control and experimental groups between the two periods. The control group had a standard deviation for the pre-training period scores of ± 0.35 while the standard deviation for the post-training period was ± 0.53 . This represents an increase in the score variability of 0.18. Since the standard error of the standard deviation²⁸ is ± 0.084 the value of t in the case of the difference in variability in

²⁸ Peters and VanVoorhis, *op. cit.*, p. 182.

TABLE III

BACKGROUND CHARACTERISTICS AND PRE- AND POST-TRAINING DRAWING SCORES OF EXPERIMENTAL AND CONTROL GROUPS MATCHED ON THE BASIS OF PRE-TRAINING SCORE

Nursery School Class	Control Group					Experimental Group					Difference in Post-Training Scores
	Child Number	Sex	Age	Drawing Score		Child Number	Sex	Age	Drawing Score		
				Pre-Training	Post-Training				Pre-Training	Post-Training	
Two-Year-Olds-----	1	F	2-3	1.1	1.5	2	M	2-4	1.1	2.5	1.0
	3	F	2-0	1.0	1.2	3	F	2-0	1.0	1.8	0.6
	4	M	2-7	1.0	1.4	4	M	2-6	1.0	2.2	0.8
Younger Three-Year-Olds	8	M	3-5	1.8	1.6	7	F	3-3	1.8	2.4	0.8
	9	M	2-10	2.0	1.8	8	M	3-5	2.10	3.2	1.4
	12	M	2-11	1.8	1.7	12	M	2-11	1.8	2.3	0.6
Older Three-Year-Olds..	14	M	3-8	1.6	1.5	18	M	3-8	1.6	2.10	0.5
	16	M	4-0	1.8	1.5	14	M	3-8	1.8	1.5	0.0
	17	M	3-11	1.4	1.3	17	M	3-11	1.4	2.2	0.9
	18	M	3-9	1.5	1.5	19	F	3-9	1.5	3.2	1.7
Four-Year-Olds-----	20	F	3-11	1.7	2.4	26	M	3-11	1.7	2.7	0.3
	23	F	4-7	1.9	3.4	24	F	4-6	1.9	2.4	-1.0
Total-----				18.6	20.8				18.6	28.4	7.6
Mean Score-----				1.55	1.73				1.55	2.36	0.63
Sigma of Distribution-----											0.66

pre- and post-training periods is 2.14. This is probably a significant difference (at approximately the five-percent level of significance).

For the experimental group the standard deviation of the drawing scores was initially ± 0.41 , and in the post-training period ± 0.46 . The change in group variability is 0.05 ± 0.077 , and hence is insignificant, the value of t being 0.65.

The increased variability noted in the control group is accounted for in part by a stretching of the distribution of the scores in the post-training period toward the high end of the scale. The increase in variability in the control group scores would, therefore, if anything, tend to favor this group in any comparison with the experimental group.

Another statistic of interest because of the possible light it may throw on the motivation in our two groups is the number of paintings the children produced. From the previous description of the method by which the drawing scores were obtained, it is evident that the score of each child was uninfluenced by the number of paintings he made. Consequently the number of paintings produced does not enter directly into the calculation of the group drawing score means. The control group increased the average number of its drawings from 9.8 in the pre-training period to 14.3 in the post-training period, or 4.5 drawings per child. The experimental group, on the other hand, better than doubled its number of

drawings, showing an average gain of 13.3 drawings from an initial mean of 10.7. The difference between the mean gain in number of drawings of the two groups was 8.8 ± 4.5 . The value of t in this case is 1.98. Thus, although the experimental group did show a decided increase in the number of pictures produced, this increase is significant only at the five-percent level.

CONCLUSIONS

It seems highly probable from the analysis of our data that the training of the sort given was effective in improving, by a significant degree, progress in the development of skill in graphic representation of our young subjects and also their interest in drawing. It also seems evident that our nursery children under a laissez-faire program over an average period of six months did not very conspicuously improve their drawing skill as a result of self-initiated learning.

This result indicates that easel painting involves a behavior-pattern sufficiently highly developed and yet still sufficiently malleable at the age of two years, as to be easily influenced by training. From this it would follow that in the nursery school situation it would be possible to develop an organized art program even for the two-year-olds which, while involving no negative effects on spontaneity and creativity in artistic behavior, could at the same time have a positive value in advancing children's drawing level.

